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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/603,118	06/22/2000	Koichi Nitta	KYOW-900-(US)	9026

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EXAMINER	
LOUIE, WAI SING	
ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 08/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/603,118	NITTA ET AL.	
	Examiner	Art Unit	
	Wai-Sing Louie	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 August 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,5,6,8-12,17 and 20-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *17,21-23 and 25-27* is/are allowed.

6)☒ Claim(s) *1,5,6,8-12,20 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 5 and 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schetzina (US 5,351,255) in view of Kuniyasu (US 6,268,230).

With regard to claim 1, Schetzina discloses a semiconductor light-emitting device (col. 9, line 9 to col. 24, line 8 and fig. 26) comprising:

- A substrate 103;
- An electrode 104 of one conductivity type, which is formed on the substrate 103;
- An intermediate layer 106, formed on the electrode 104 of a conductivity type, is a solder material (col. 19, lines 12-15), but Schetzina does not disclose the layer is made of at least one of In, Ag, Ni and Cr. However, Kuniyasu discloses the solder is made of In (Kuniyasu col. 6, lines 50-53). Kuniyasu teaches the In solder is able to alloy with the electrodes at low temperature and will not deteriorate the electrical and optical characteristics of the semiconductor chip (Kuniyasu col. 1, line 54 to col. 2, lines 4). Therefore, it would have been obvious at the time the invention was made to modify Schetzina's device with the teaching of Kuniyasu to use the In solder as an intermediate layer in order to bond the electrodes and

will not deteriorate the electrical and optical characteristics of the semiconductor layers;

- A reflective layer 13 which is formed on the intermediate layer 106, contains a metal, and reflects light (col. 19, lines 4-6);
- A light-emitting layer 101 formed on the reflective layer to emit light, having a double-heterostructure in which an active layer 101 is sandwiched between first and second cladding layers 16 and 17;
- A transparent electrode 102 formed the light-emitting layer.

With regard to claim 9, Schetzina discloses the transparent electrode 102 is formed of ITO (col. 18, lines 44-45).

With regard to claim 10, Schetzina discloses the substrate contains a metal (col. 19, lines 9-11).

With regard to claim 11, Schetzina discloses the first and second cladding layers 16 and 17 are set bandgap larger than a bandgap of the active layer 101 (fig. 16a and 17).

With regard to claim 12, Schetzina discloses the active layer 101 could be single or multiple quantum well structure including a well layer and a barrier layer (col. 18, lines 32-38 and fig. 16a-p).

With regard to claim 5, Schetzina discloses a contact layer 18 of the one conductivity type (col. 11, lines 40-42) and a graded layer 19 having uniform ratio of zinc to mercury (col. 11, lines 43-46) and providing a linear graded doping to match the doping concentration of the cladding layer 17 (col. 11, lines 60-63 and fig. 14). Although, Schetzina does not name this layer as a strain-relaxing layer, however, layer 19 is functioned as a strain-relaxing layer. Layer 19 is

formed between the reflective layer 13 and the light-emitting layer 101, where layer 19 has a middle band GaP between the contact layer and the cladding layer 17 (fig. 14).

With regard to claim 8, Schetzina discloses the first ohmic electrode 13 is of ITO, which is a known transparent material (col. 12, lines 43-46) and a metal electrode 104 (col. 19, lines 6-7) forming a two-layered structure.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schetzina (US 5,351,255) in view of Biing-Jye et al. (US 6,169,294).

With regard to claim 6, Schetzina discloses a contact layer 16 of opposite conductivity type formed between the light-emitting layer 101 and the transparent electrode 102, but Schetzina does not disclose the layer 16 contains InGaP or InGaAlP. However, Schetzina discloses a Group II-VI light-emitting structure and Schetzina also discloses the structure could be made of Group III-V compound (col. 22, lines 26-33). Biing-Jye et al. disclose a similar light-emitting structure constructed by Group III-V compound. Biing-Jye teaches the III-V family semiconductor has the highest energy bandgap and suitable for short wavelength, high efficiency device (Biing-Jye col. 1, lines 7-11). Therefore, it would have been obvious to one with ordinary skill in the art to modify Schetzina's device with the teaching of Biing-Jye to construct a light-emitting structure of Group III-V compounds in order to produce a high efficiency light-emitting device. The Group III-V semiconductor compound would include the InGaP or InAlGaP.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schetzina (US 5,351,255) in view of Bour et al. (US 5,977,612).

With regard to claim 20, Schetzina does not disclose the shape of the light-emitting element is a polygonal prism having at least five corners or a circular cylinder. However, Bour et al. disclose a cylindrical LED on a hexagonal crystallite structure 200 and a circular light-emitting element 202 (Bour fig. 2a & 2b). Bour et al. teach the conventional LED structures require a separation between LED structures (Bour col. 2, lines 1-4), but an array of crystallites could be formed in a single substrate (Bour col. 3, lines 1-15) by taking advantage of the natural lattice structure of III-V compound (Bour col. 2, line 48-60). Therefore, it would have been obvious to one with ordinary skill in the art to modify Schetzina's device with the teaching of Bour to have a hexagonal or cylindrical light-emitting structure in order to form a high-density integrated device.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schetzina (US 5,351,255) in view of Paoli et al. (US 5,138,625).

With regard to claim 24, in addition to limitation disclosed in claim 1-2, and 14 above, Schetzina also discloses:

- Schetzina does not disclose an interface of the contact layer in contact with the first cladding layer is corrugated to have a gradient index and light emitted by the light-emitting layer is reflected by the interface. However, Paoli et al. disclose a LED having a corrugated interface between the contact layer 300 and cladding layer 296 (Paoli col. 12, lines 7-41 and fig. 12). Paoli et al. teach the V-groove of the corrugated interface polarizes the light beam parallel to the plane of incidence (Paoli col. 6, lines 1-9 and col. 12, lines 1-18). Therefore, it would have been

obvious to one with ordinary skill in the art to modify Schetzina's device with the teaching of Paoli et al. to provide a corrugated interface between the contact layer and cladding layer. Doing so would control the polarization of the light emission.4

Allowable Subject Matter

Claims 17, 21-23, and 25-27 is allowed. The following is an examiner's statement of reasons for allowance:

With regard to claim 17, References Schetzina does not disclose a recess on the contact layer. Takeuchi et al. disclose a recessed surface on the contact layer formed to improve light extraction efficiency, but do not disclose the limitation of "light reflecting electrode formed on the recessed surface of the contact layer". Therefore, Schetzina and Takeuchi et al. do not disclose the claimed invention.

With regard to claim 21-23 and 26-27, References Schetzina and Suzuki et al. do not disclose the photonic crystal layer as recited in claim 21-23 and 26-27. Therefore, Schetzina and Suzuki et al. do not disclose the claimed invention.

With regard to claim 25, Schetzina does not disclose a substrate with a rounded edge fused to a photonic crystal layer and claim 25 is allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Arguments

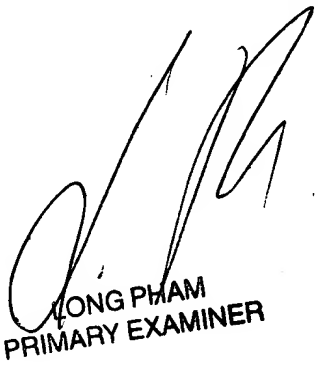
Applicant's arguments filed 8/1/03 have been fully considered but they are not persuasive.

- Applicant argues that Schetzina has no description that layer 106 contains Ag, In, Ni, or Cr. However, the newly cited reference Kuniyasu discloses the solder is made of In and meets the claimed limitation.
- Applicant argues the secondary reference Bour et al. disclose a laser diode, but the laser diode is not included in the scope of claim 20. However, laser diode is also a light-emitting device. Schetzina modified by Bour et al. meet the claimed invention in claim 20.
- Applicant has disclosed the difference between the claimed invention and the references Schetzina, Takeuchi et al., and Suzuki et al. the rejection of claims 17, 21-23, and 25-27 in previous office action are withdrawn and claims 17, 21-23, and 25-27 are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (703) 305-0474. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



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August 5, 2003